Ammoniation of Low Quality Roughages**

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With drought conditions reducing the supply and increasing the price of hay in the region, producers may want to consider utilizing crop residues such as wheat straw, barley straw, and corn stover in their supplemental feed strategies. Application of anhydrous ammonia provides an opportunity to substantially improve the nutrient characteristics of these roughages. The use of this technology has grown considerably in the past 15 years. In general, a stack of roughage is covered with polyethylene sheet to create an air and ammonia tight seal. Anhydrous ammonia is injected into the stack and allowed to react with the roughage for one to four weeks.

Ammoniation improves roughage nutritive value by:

- Increasing roughage digestibility
- Increasing roughage intake
- Increasing crude protein content

Research indicates gestating cows fed ammoniated wheat straw had a higher roughage intake and weight gain compared to cows fed wheat straw and supplemented with alfalfa hay as a protein source.

	Straw + Alfalfa	Ammoniated Straw
Roughage intake, lb/day	21.8	26.1
Cow weight change, lb/day	-.27	.10

Ward et al., University of Nebraska, 1982.

Results of roughage ammoniation trials

	% Crude Protein		% D.M Digestibility		Increase In
Roughage	Untreated	Treated	Untreated	Treated	D.M Intake
Wheat Straw	3.7	9.7	38.9	48.0	18%
Corn Stover	6.2	11.0	48.0	56.2	22%
Prairie Hay	5.8	14.7	49.5	58.2	-

Kuhl, Kansas State University, 1981.

How to Ammoniate

1. Determine the roughage weight of the entire stack. Weigh at least five bales. Determine roughage moisture content.
2. Calculate the amount of anhydrous ammonia to be applied. Research has shown that approximately 3% ammonia on a roughage DM basis (60 lbs. per ton of DM) provides good results. Prepare the stack, calculate the total amount of ammonia

needed, and then place an order for a tank that contains no more than the amount needed.

3. Arrange bales so that a single sheet of polyethylene (usually 40 X 100 ft.) can cover the entire stack with at least 2 ft. of surplus sheeting along all edges so the stack can be sealed. For large round bales, a pyramid three bales high with three forming the base or two bales high with four forming the base works well depending on bale size. It is not necessary to place polyethylene between the ground and hay.
4. The ammonia can be applied through a hose or pipe extending from the tank under the plastic and terminating near the center of the stack.
5. Cover the stack with a single sheet of polyethylene (6-mil or 8-mil thickness). Black polyethylene is recommended. Be careful not to tear the polyethylene while covering the stack. Repair all tears or holes to prevent loss of ammonia. To make the stack air tight, seal all edges of the polyethylene using at least eight inches of soil, fine rock, or other weighty material.
6. Apply ammonia slowly (no more than 30 lbs. of ammonia per minute). Slow application will prevent ballooning and stretching of the polyethylene sheet. Apply the ammonia during late evening or night hours will minimize gas expansion and sheet stretching.
7. The length of time required for the stack to remain sealed depends on the environmental temperature as shown below:

Temperature (degree F)	Weeks of treatment
Below 40	More than 8
40 to 60	4 to 8
60 to 80	2 to 4
Above 80	2

Keep hay covered until a few days prior to feeding. Ammoniated hay takes on moisture more readily and is more susceptible to spoilage than untreated hay. Uncovering the stack two days prior to feeding will allow any excess ammonia to escape.

Precautions

Ammoniation of moderate and high quality forages can cause toxicity in cattle. Restrict ammoniation to mature, low quality roughages. Ammoniation of high quality roughages such as alfalfa, small grain hays, or any moderate to early harvested grass hay, can lead to toxicity known as “crazy cow syndrome”. Symptoms include hyperexcitability, circling, convulsions, and even death. To minimize the risk of toxicity: 1) Do not ammoniate moderate or high quality forages, 2) Do not apply more than 4% ammonia on a dry matter basis, 3) Do not ammoniate roughage that has wet spots from recent heavy rains because ammonia will concentrate in these wet spots, 4) Do not feed to cows with calves less than one month old.

****Adapted from Oklahoma State University Extension Facts F-2243.**

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